

in view of Arakawa et al (5,757,833). Claims 3-4, 11-14, 29-30, 33-38 and 41-44 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Eglash et al (5,251,255) in view of Jewell et al. (6,359,920). Claims 15-28, 31-32 and 39-40 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Eglash et al (5,251,255) in view Jewell et al. (6,359,920) and further in view of Spruytte et al (US2002/0075920).

With his response to the first Office Action, Applicant has cancelled claim 29-44, and has amended claim 1. Applicant has added new claims 45- 59. Claims 1-28 and 45-59 now remain pending in the present application. Applicant believes his amendment to claim 1 and specification and the following remarks overcome the present rejections and respectfully request reexamination of his application for patent.

## **II. Provisional rejection under “double patenting” doctrine.**

Claims 1-44 stand provisionally rejected under the judicially created doctrine of double patenting over claims 1-59 of co-pending Application number 10/026,044, claims 1-6 of co-pending Application No. 10/026,055, and claims 1-34 of co-pending Application No. 10/026,016. Applicant respectfully traverses the provisional rejection for the following reasons:

First, the present invention, as presented in independent claims 1, claims a VCSEL with “*InGaAsSb*” in its quantum well and having a well depth of at least 40 meV. Application number 10/026,044 independently claims “*Indium free*” VCSELs. Application No. 10/026,055 independently claims “*InGaAs*” in quantum wells that have a well depth of at least 40 meV. Application No. 10/026,016 independently claims “*InGaAsSbN*” in quantum wells that have a well depth of at least 40 meV. The Applicant will not include the distinguishing material elements identified above in quotes for each application into that of another co-pending application. The titles for each case clearly set forth the distinctions between all four applications. These distinctions will be maintained throughout prosecution until issuance of patents by the Applicant.

Second, all three applications cited by Examiner and the present application were filed by a common inventor, Dr. Ralph Johnson, for a common assignee, Honeywell International, on

the same date, December 27, 2001. A double-patenting doctrine rejection seeks to prevent the extension of exclusivity sought by an applicant for an invention by filing subsequent applications covering the same subject matter. Applicant or his assignee cannot extend the term of protection available for its filings of the four associated applications being that each was filed on the same day and will expire twenty years from their filing under current U.S. Patent law.

The double-patenting doctrine also protects a licensee or the public where the lack of notice regarding common inventions may operate to the detriment of the licensee or public when subsequent "related" patents may issue. Applicant has amended the present application to provide notice via any patent that may issue that other related patent applications or patents for the present invention exist. The following notice, which will be entered on the first page of all related applications including the present application, should provide adequate notice:

The present invention is related to the following co-pending patent applications: Serial No. 10/026,016 entitled "Vertical cavity surface emitting laser including indium, antimony and nitrogen in the active region," filed December 27, 2001; Serial No. 10/026,019 entitled "Vertical cavity surface emitting laser including indium and nitrogen in the active region," filed December 27, 2001; Serial No. 10/026,044 entitled "Indium free vertical cavity surface emitting laser," filed December 27, 2001; and Serial No. 10/026,055 entitled "Vertical cavity surface emitting laser including indium in the active region," filed December 27, 2001.

Applicant believes that his application does not pose a double-patenting issue given the different focus of his invention as provided in claim 1 as originally presented, and now newly submitted independent claims 45 and 53, when compared to the distinct claim scope for the co-pending applications, because of the common filing date and ownership of the applications, and because the application has been amended to provide notice regarding the existence of associated applications/patents. For these reasons, Applicant respectfully request withdrawal of the provisional double patenting rejection.

III. Objections Under 35 U.S.C. § 112

Claims 1-44 stand rejected under 35 U.S.C. 112, second paragraph, as begin indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the inventions. Claim 1 was cited specifically for failing to provide any means, any structure and any structural relationship in order to support the VCSEL in the claims which render the claims confusing, vague and indefinite according the Examiner. Applicant respectfully traverses the rejection.

Applicant has amended Claim 1 in a manner that should further clarify the structural relationship between the elements (e.g., quantum well, barrier layers, and confinement layers) therein. A person skilled in the art of VCSELs understands the basic structure of semiconductor lasers. Applicants claims, when interpreted by those skilled in the art in light of Applicant's detailed specification, *Orthokinetics, Inc. V. Safety Travel Chairs, Inc.*, 806 F.2d 1565, 1576, 1 USPQ2d 1081, 1088 (Fed. Cir. 1986), sets forth the basic interrelationship between the quantum well, barrier layers and confining layers of a VCSEL device. Applicant's claims set forth the interrelationship of the quantum well, barrier layers and confining layers throughout the detailed specification and the claims apprise one of ordinary skill in the art of their intended scope. All the prior art of record cited by Examiner is also consistent in teaching a well-known and basic VCSEL structure that is generally used by Applicant is describing and claiming his invention. The interrelationship is clearly set forth in Applicant's claims as illustrated in italics and underline below:

1. A vertical cavity surface emitting laser (VCSEL), comprising:

an active region further comprising at least one quantum well having a well depth of at least 40 meV and comprised of InGaAsSb and barrier layers sandwiching said at least one quantum well; and  
confinement layers sandwiching said active region.

The United States Patent and Trademark Office has recognized the ongoing concern presented by applicants regarding amendments to applications in light of *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co.*, 122 S.Ct. 1831, 62 USPQ2d 1705 (2002). The Office has clarified its policy with respect to rejections made under 35 U.S.C. § 112, second paragraph (effective immediately as of January 17, 2003, in a memorandum from Stephen G. Kunin, Deputy Comm. for Patent Examination Policy). According to current policy which will be published in the next revision of the MPEP (§ 2173.02), "during examination of claims for compliance with the requirements for definiteness under 35 U.S.C. § 112, second paragraph, some latitude in the manner of expression and the aptness of terms should be permitted even though the claim language is not as precise as the examiner might desire." The memorandum goes on to say, "the examiner must consider the claim as a whole to determine whether the claim apprises one of ordinary skill in the art of its scope and, therefore, serves the notice function required by 35 U.S.C. § 112, second paragraph by providing clear warning to others as to what constitutes infringement of the patent." (Citing *Solomon v. Kimberly-Clark Corp.*, 216 F.3d 1372, 1379, 55 USPQ2d 1279, 1283 (Fed. Cir. 2000).)

Applicant believes that he has done a good job of setting forth the structural elements and the interrelationship between elements in his claims as evidenced by Examiners use of similar language throughout the 35 U.S.C. § 103 discussion of the Office Action (see page 6, first paragraph, and page 8, paragraph 9, of the Office Action). Applicant's means of setting forth the structure and interrelationship of the quantum well(s), barrier layers, and confining layers is believed to be clear, simple and intuitive by the less than the skilled, falls within the scope of the Office's new guidance, and is well supported throughout the detailed specification.

For the foregoing reasons, Applicant respectfully traverses the rejection of his claims under 35 U.S.C. § 112, paragraph 2, as being indefinite.

#### **IV. Rejections under 35 U.S.C. § 102**

Claims 1 stands rejected under 35 U.S.C. § 102 as being anticipated by Eglash et al (5,251,255). The Examiner describes how the Eglash et al device can achieve power between

an intense peak of 1.88 micrometers with full width at half maximum of 11 meV. The Examiner's focus on power or efficiency indicates that there may be some initial confusion regarding Applicants well depth of at least 40 meV and Eglash et al's power achievements.

The "meV" discussion in Eglash et al is not directed to quantum well depths. Eglash et al is concerned with how much band gap efficiency or performance can be obtained using their device and techniques when referring to measurements in the quantity "meV."

By contrast to Eglash et al, Applicant is referring to achieving optimum band offset using quantum wells having depths of at least 40 meV. This "band offset" is clearly set forth in Claim 1 with respect to the quantum well element. Discussions of band offset achieved by quantum well depth *and* band gap efficiency are not interchangeable, as would be understood by those skilled in the art. When referring to a discussion of "band offset," one skilled in the art should realize that applicant is achieving optimum confinement of carriers within the quantum well(s) for his device where the quantum well(s) comprises well depth of at least 40 meV.

Eglash does not teach a quantum well having a depth of at least 40 meV, therefore Applicant's Claim 1 is not anticipated. For the foregoing reasons, the rejection of claim 1 is respectfully traversed.

#### V. Rejections under 35 U.S.C. § 103(A)

##### *Eglash and Spruytte*

Claims 2 and 7-10 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Eglash et al (5,251,255) in view of a published application by Spruytte et al (US2002/0075920) in June 20, 2002. Applicants case was filed December 27, 2001, which predates the publication by Spruytte relied on by Examiner. Spruytte cannot be used as prior art against Applicant because of its newer publication and effective notice date to Applicant. For this reason the rejection of claims 2 and 7-10 is respectfully traversed.

**Eglash and Arakawa**

Claims 5-6 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Eglash et al (5,251,255) in view of Arakawa et al (5,757,833).

As discussed above, Eglash et al describes how a device can achieve power between an intense peak of 1.88 micrometers with full width at half maximum of 11 meV. The discussion in Eglash et al is not directed to quantum well depths. Eglash et al is concerned with how much band gap efficiency or performance can be obtained using their device and techniques when referring to measurements in the quantity “meV.”

By contrast to Eglash et al, Applicant is referring to achieving optimum band offset using quantum wells having depths of at least 40 meV. This “band offset” is clearly set forth in Claim 1 with respect to the quantum well element. Discussions of band offset achieved by quantum well depth and band gap efficiency are not interchangeable, as would be understood by those skilled in the art. When referring to a discussion of “band offset,” one skilled in the art should realize that applicant is achieving optimum confinement of carriers within the quantum well(s) for his device where the quantum well(s) comprises well depth of at least 40 meV.

Eglash et al does not teach a quantum well having a depth of at least 40 meV, therefore Applicant’s Claims 5-6 are not obviated by the combination of Eglash et al with Arakawa et al. For the foregoing reasons, the rejection of claims 5-6 is respectfully traversed.

**Eglash and Jewell**

Claims 3-4, 11-14 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Eglash et al (5,251,255) in view of Jewell et al. (6,359,920). As discussed above, Eglash does not teach quantum well depths of at least 40 meV. Applicant’s claims therefore overcome a rejection using Eglash et al as a reference. The rejection of claim 3-4, 11-14 is therefore respectfully traversed.

Applicant respectfully points out to the Examiner before engaging in further discussion of the distinctions between his invention and the cited art that U.S. Patent 6,359,920 was issued on March 19, 2002, which defeats its use as a prior art reference as a basis for the current rejections; however, Applicant is and has become very familiar with the subject matter described by Jewell et al in the patent, as it is a divisional application of U.S. Patent Nos. 5,825,796 and 5,960,018, also issued to Jewell et al. Applicant acknowledges the general subject matter relied on by Examiner in citing the '920 to the extent it is provided in the '796 and '018 patents, which truly predate Applicant's filing of the present invention.

Applicant notes that Jewell et al, has been cited for its use of nitrogen, noting specifically that Jewell's use of N is at a quantity of less than 1%. Examiner rejects claim 13 based on the use of <1% N by Jewell et al, stating that it has been held that discovering an optimum value of a result effect variable involves only routine skill in the art (citing *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980)). The rejection of claim 13 is respectfully traversed.

Applicant submits that it has been a long standing practice in the field to use less than 1% of nitrogen within the active region of a VCSEL because good luminescence has generally been hard to achieve where greater than 1% nitrogen is used. The use, however, of nitrogen at quantities approaching 1% has also shown longer wavelength production in VCSEL devices. Applicant has overcome convention through the use of greater than 1% nitrogen in his devices, which has led to longer emission wavelengths. Use of greater than 1% nitrogen would not be an obvious practice to the skilled, as further proven by the Jewell et al reference specifically to use of less than 1%, because of the common practice of not exceeding more than 1% nitrogen to avoid device performance and failure concerns. For example, a difficulty that is experienced in the art where more than 1 % nitrogen is used in a device has been poor luminescence efficiency due primarily to the creation of non-radiative traps caused by increased (greater than 1%) nitrogen. Through his combination of materials and device architecture, Applicant has overcome device performance issue where greater than 1% nitrogen is used. For these reasons, the rejection of Claim 13 is respectfully traversed.

*Eglash Jewell and Spruytte*

Claims 15-28 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Eglash et al (5,251,255) in view Jewell et al. (6,359,920) and further in view of Spruytte et al (US2002/0075920).

As identified by Applicant above, Spruytte et al (US2002/0075920) was published in June 20, 2002, while Applicants case was filed December 27, 2001, which predates publication by Spruytte. Spruytte cannot be used as prior art against Applicant because of its newer publication and effective notice date to Applicant. For this reason the rejection of claims 15-28 using Spruytte is improper and is respectfully traversed.

**VI. Conclusion**

Applicant has amended claims herein for the purpose of providing additional scope, clarity and some consolidation. The specification was amended to provide a notice of co-pending applications and to correct the citation to a U.S. patent (5,903,588) in the description. No new subject matter has been introduced as a result of this amendment. Attached hereto is a marked-up version of the changes made to the Specification and Claims by the current response, which is captioned "VERSIONS WITH MARKING TO SHOW CHANGES MADE."

In view of the foregoing discussion, Applicant has responded to each and every objection and rejection of the Official Action, and respectfully request that a timely Notice of Allowance be issued. Applicant respectfully submits that the foregoing amendment and discussion does not present new issues for consideration and that no new search is necessitated. Accordingly, Applicant respectfully requests reconsideration of Claims 1-28 and examination of new claims 45-59.

Applicant believes he has demonstrated that his disclosed and claimed invention is novel and non-obvious relative to the prior art. Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact



the undersigned representative to conduct an interview before further written action in an effort to expedite prosecution in connection with the present application

Respectfully submitted,

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PATENT  
Attorney Docket No. V637-02670-US

**VERSIONS WITH MARKING TO SHOW CHANGES MADE**

*In re* Application of : Ralph H. Johnson : Docket No. V637-02670-US  
Serial No. : 10/026,020 : Art Unit No. 2828  
Filing Date : 12/27/2001 : Examiner. Tuan M. Nguyen  
Invention Title : Vertical cavity surface emitting laser including indium and antimony  
in the active region

**IN THE SPECIFICATION:**

**Please insert the following paragraph on 1 after the Title and the paragraph entitled "TECHNICAL FIELD":**

**--RELATED APPLICATIONS**

The present invention is related to the following co-pending patent applications: Serial No. 10/026,016 entitled "Vertical cavity surface emitting laser including indium, antimony and nitrogen in the active region," filed December 27, 2001; Serial No. 10/026,019 entitled "Vertical cavity surface emitting laser including indium and nitrogen in the active region," filed December 27, 2001; Serial No. 10/026,044 entitled "Indium free vertical cavity surface emitting laser," filed December 27, 2001; and Serial No. 10/026,055 entitled "Vertical cavity surface emitting laser including indium in the active region," filed December 27, 2001.--

**On Page 15, replace the first full paragraph providing textual reference to Figure 12 with the following paragraph:**

--Referring to Figure 12, illustrated is a sectional view of a vertical cavity surface emitting laser 100 (VCSEL). The VCSEL 100 can be grown by techniques such as metal organic molecular beam epitaxy, or metal-organic chemical vapor deposition. Reference is made to U.S. Patent No. ~~5,903,589~~ 5,903,588, assigned to

the assignee for the present invention, which describes methods of VCSEL fabrication use in the art. The VCSEL can preferably be grown on a GaAs substrate 101 due to the robust nature and low cost of the material, however it should be recognized that semiconductor materials, Ge for example, could also be used as the substrate. The VCSEL 100 can then be formed by disposing layers on the substrate.--

**IN THE CLAIMS:**

**Cancel Claims 29-44 without prejudice.**

**Please amend claim 1 where indicated below:**

1. (*Once amended*) A vertical cavity surface emitting laser (VCSEL), comprising:

an active region further comprising at least one quantum well having a well  
depth of at least 40 meV and comprised of InGaAsSb; and barrier layers  
sandwiching said at least one quantum well; and  
confinement layers sandwiching said ~~barrier layers~~active region.

**Please add the following new claims, 45-59:**

-- 45. A vertical cavity surface emitting laser (VCSEL), comprising:  
an active region further comprising at least one quantum comprised of  
material including InGaAsSb and greater than 1% nitrogen, said at least one  
quantum well having a well depth of at least 40 meV, and barrier layers sandwiching  
said at least one quantum well; and  
confinement layers sandwiching said active region.

46. The VCSEL of claim 45 wherein said barrier layers are comprised of GaAsN.

47. The VCSEL of claim 45 wherein said barrier layers are comprised of GaAs and at least one of P and Al.

48. The VCSEL of claim 45 wherein said confinement layers are comprised of AlGaAs.

49. The VCSEL of claim 46 wherein said confinement layers are comprised of AlGaAs.

50. The VCSEL of claim 47 wherein said confinement layers are comprised of AlGaAs.

51. The VCSEL of claim 48 wherein said barrier layers are comprised of GaAsN.

52. The VCSEL of claim 48 wherein said barrier layers are comprised of GaAs and at least one of P and Al.

53. A vertical cavity surface emitting laser (VCSEL), comprising:  
an active region further comprising at least one quantum comprised of material including InGaAsSb and greater than 1% nitrogen, said at least one quantum well having a well depth of at least 40 meV and a thickness up to and including 50Å, and barrier layers sandwiching said at least one quantum well; and  
confinement layers sandwiching said active region.

54. The VCSEL of claim 53 wherein said barrier layers are comprised of GaAsN.

55. The VCSEL of claim 53 wherein said barrier layers are comprised of GaAs and at least one of P and Al.

56. The VCSEL of claim 53 wherein said confinement layers are comprised of AlGaAs.

57. The VCSEL of claim 54 wherein said confinement layers are comprised of AlGaAs.

58. The VCSEL of claim 55 wherein said confinement layers are comprised of AlGaAs.

59. The VCSEL of claim 56 wherein said barrier layers are comprised of GaAs and at least one of N, P and Al. --